

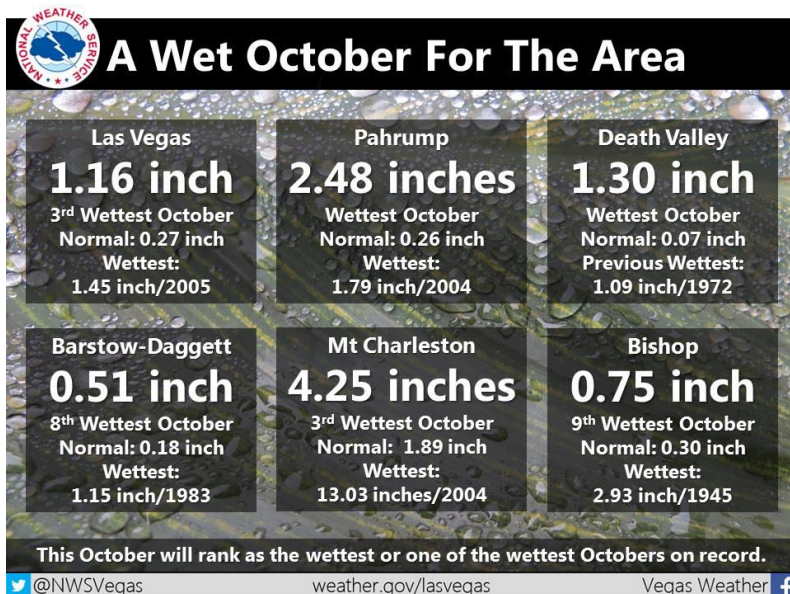
October 2015 Flash Flooding & Thunderstorms

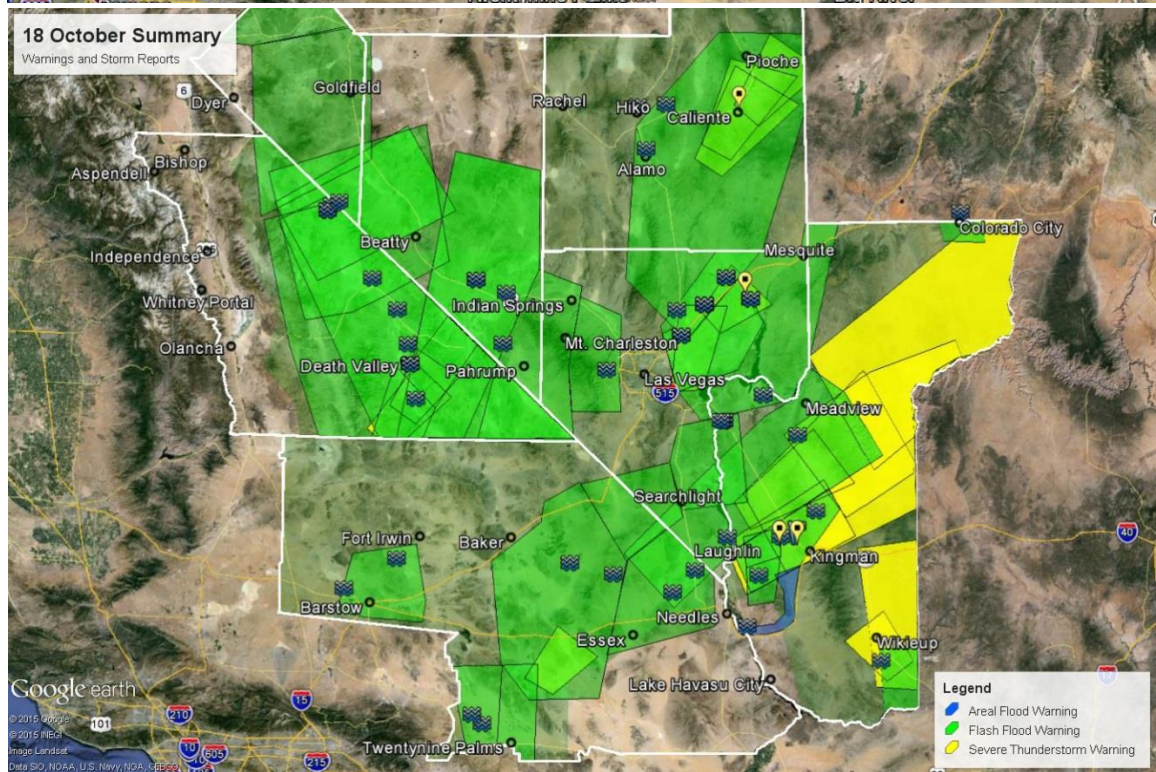
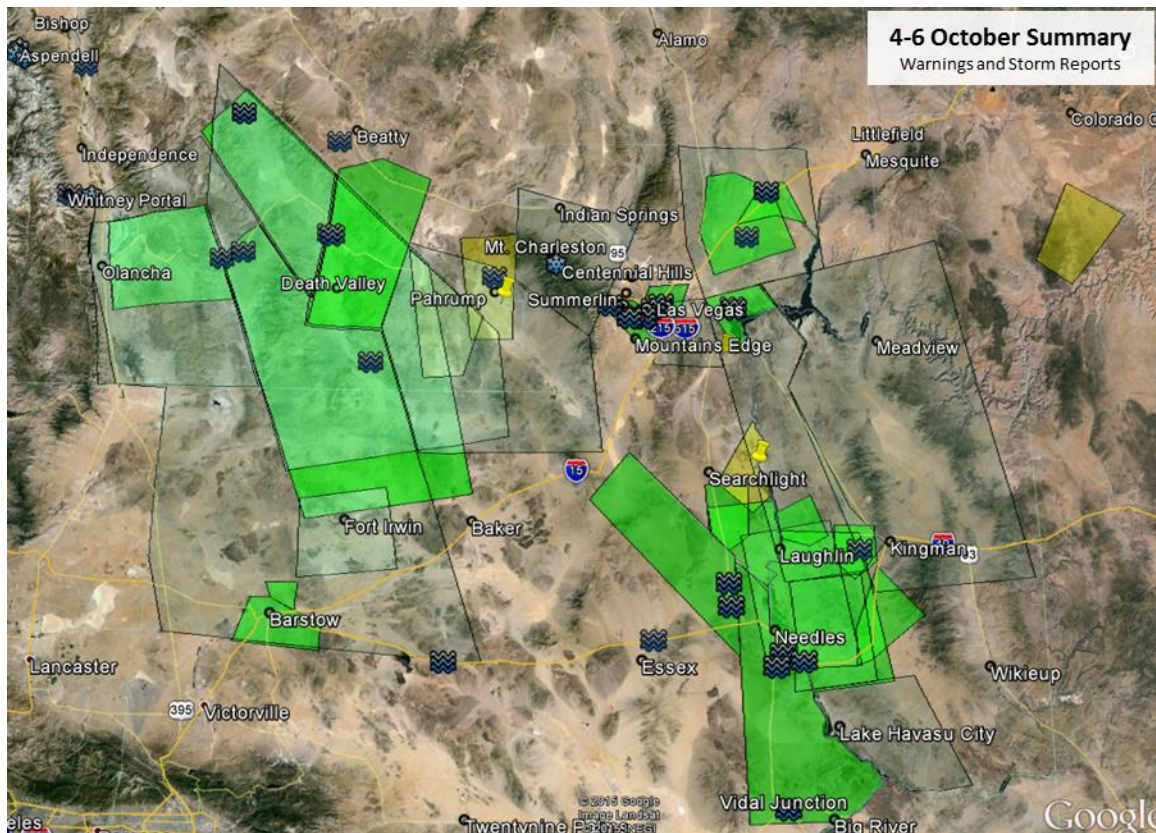


Scotty's Castle Road washed out by a flash flood on October 18. Photo courtesy of Death Valley National Park.

Introduction/ Setup

One unusual storm system managed to dominate the weather across the region for much of October, yielding two periods of active weather in the first three weeks of the month. Both weather events led to damaging flash flood events across portions of the Mojave Desert and Southern Great Basin, especially across Death Valley National Park. Severe weather was also common, as large hail and high winds impacted areas around the region during both periods of weather. Several funnel clouds also made a rare appearance with some of the strongest thunderstorms. The events, which spanned from October 4-6th and October 15th-20th, helped make October 2015 one for the record books for some.

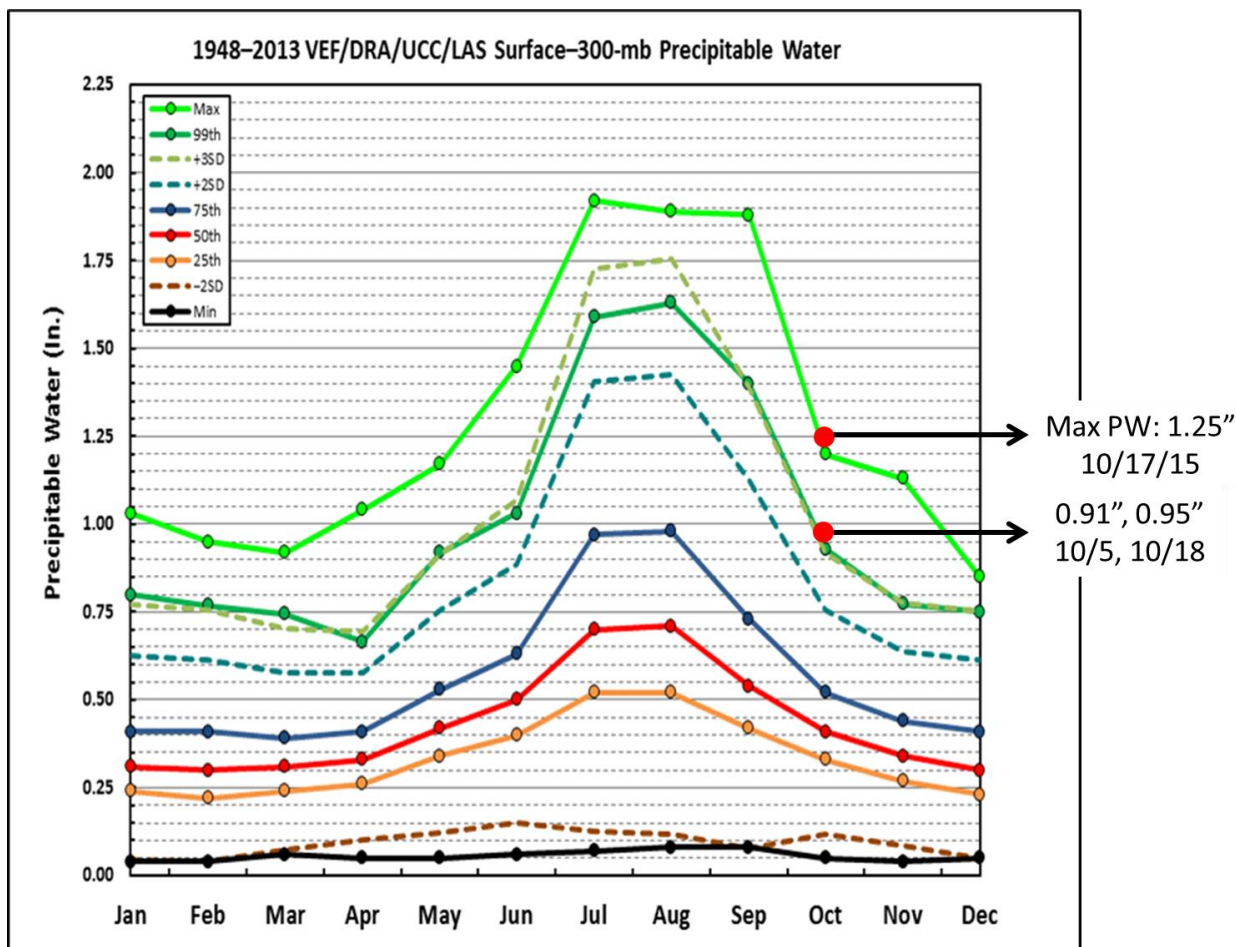




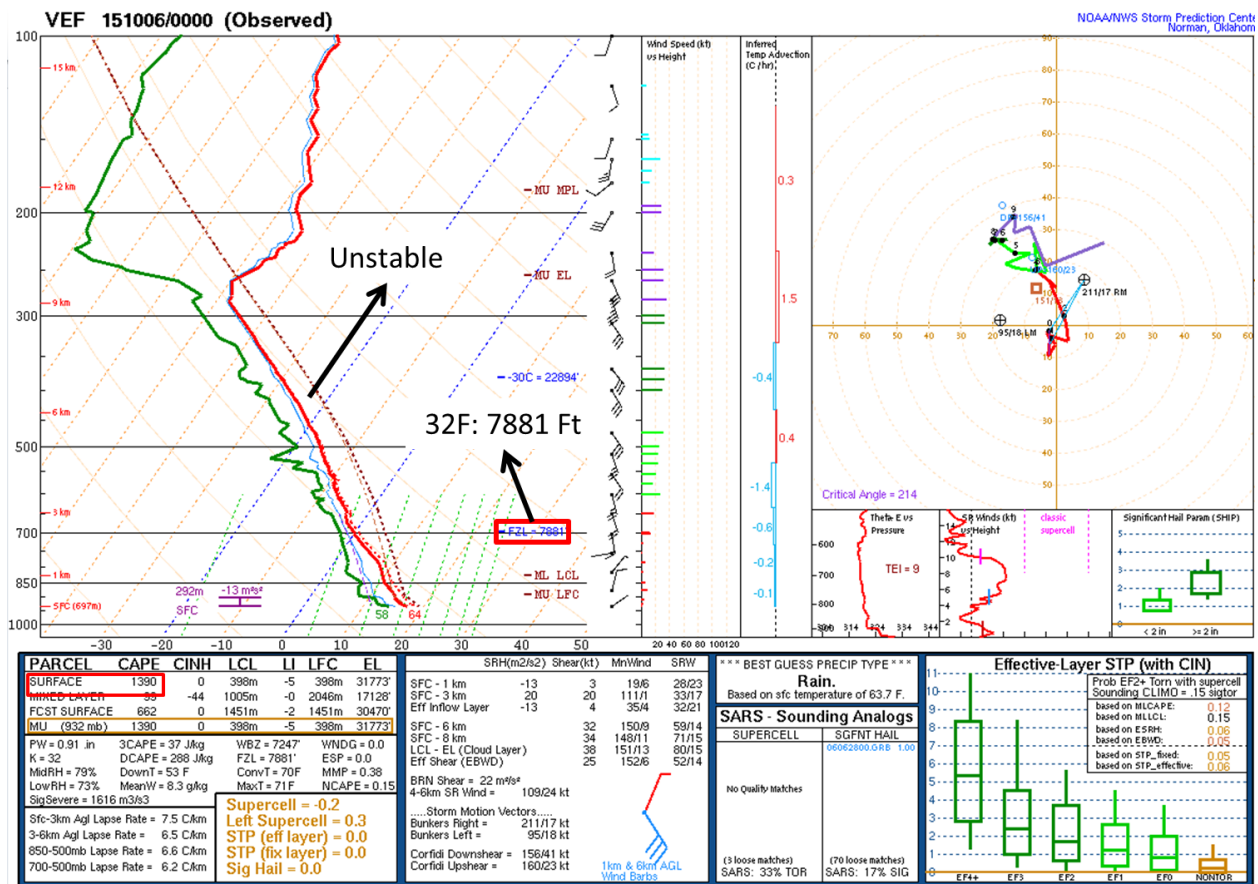
Here is a summary of the warnings issued for the October 4-6th (top) and 18th (bottom) events. There were 23 warnings issued during the October 4-6th event, with 45 different reports of flash flooding or severe weather, and 35 warnings on October 18th with 50 reports.



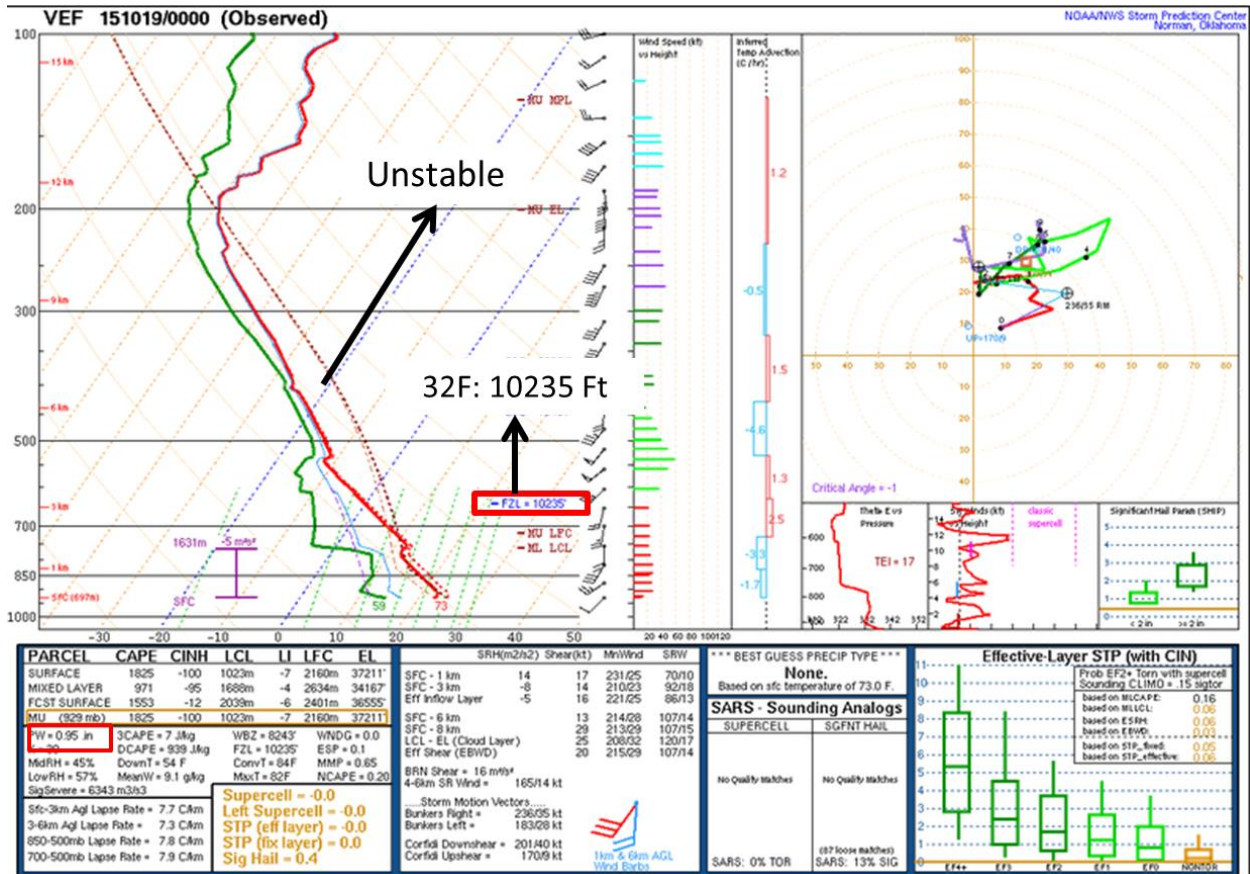
Here is the unusual path of the upper level low pressure system responsible for the periods of active weather this October. The low originated in Washington on October 2nd before it dove southward into the region by October 4th, causing the first round of active weather. The low then moved south over northern Mexico before moving westward to set up for another pass across the Southwest October 15-20th. This system combined with energy from another upper disturbance to fuel widespread thunderstorms across the region on October 18th.



The upper level low brought rich Gulf of California moisture to the area early in the month, with higher than normal humidity lingering in the area for three weeks before drying out to normal values late in the month. Precipitable water is a parameter used to identify how much moisture there is vertically through the atmosphere. Precipitable water values for the October 5th and 18th events measured roughly three standard deviations above normal for October. The measured value of 1.25 inches on the morning of October 17th broke the all-time precipitable water record for the month of October.

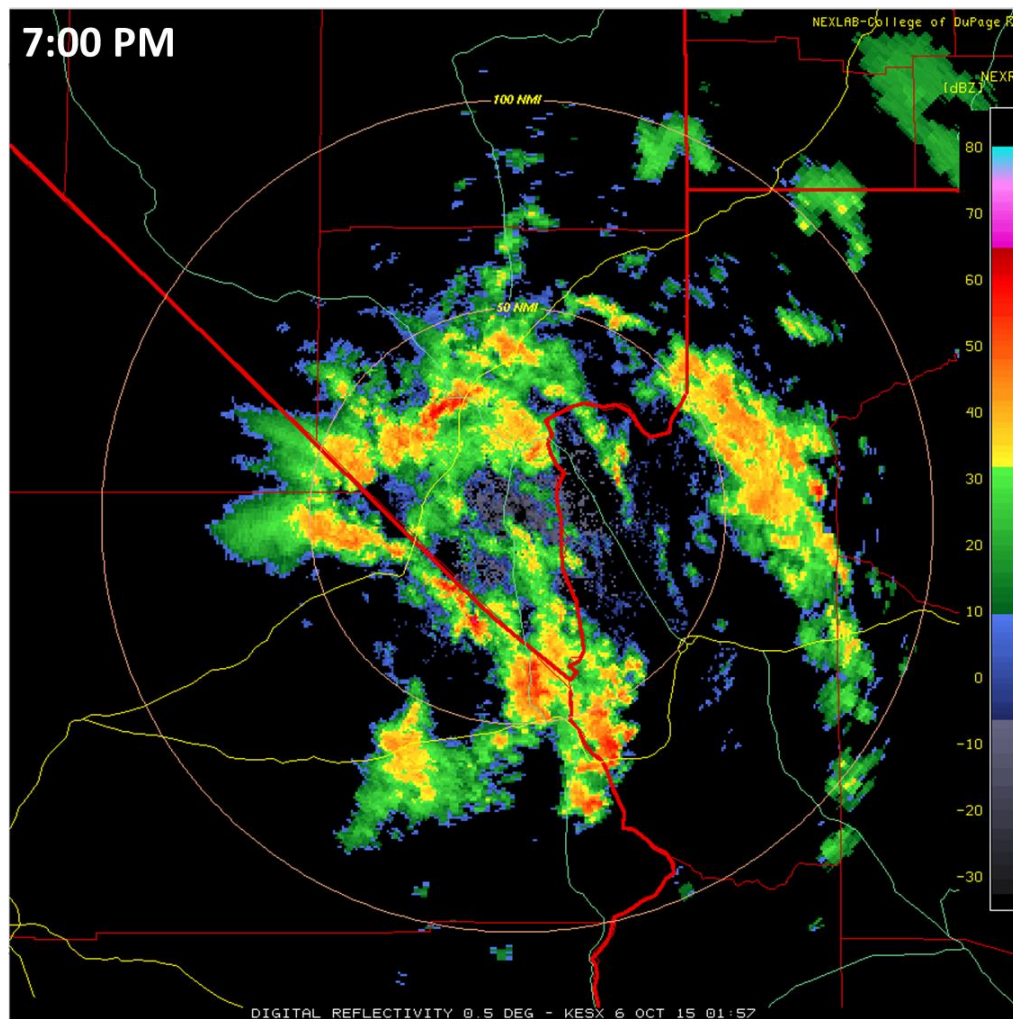


This is the afternoon sounding from the NWS Las Vegas office on October 5th. There are several items of note on this sounding that set the stage for flash flooding and severe weather. First, there was plenty of instability (almost 1400 J/KG) to fuel thunderstorm development across the region. This combined with freezing levels below 8000 feet due to the cold upper level low over the region, made hail a distinct possibility with stronger thunderstorms. Hail was observed in several places across the region, with the largest hail measuring 1.25" just east of Boulder City, Nevada. Finally, abundant moisture through the lower and mid levels of the atmosphere (the red temperature line and green dewpoint lines in close proximity of each other) indicated a primed atmosphere for flash flooding. Flash flooding occurred as a result of heavy thunderstorms over western portions of the Las Vegas valley several hours after this sounding was observed.

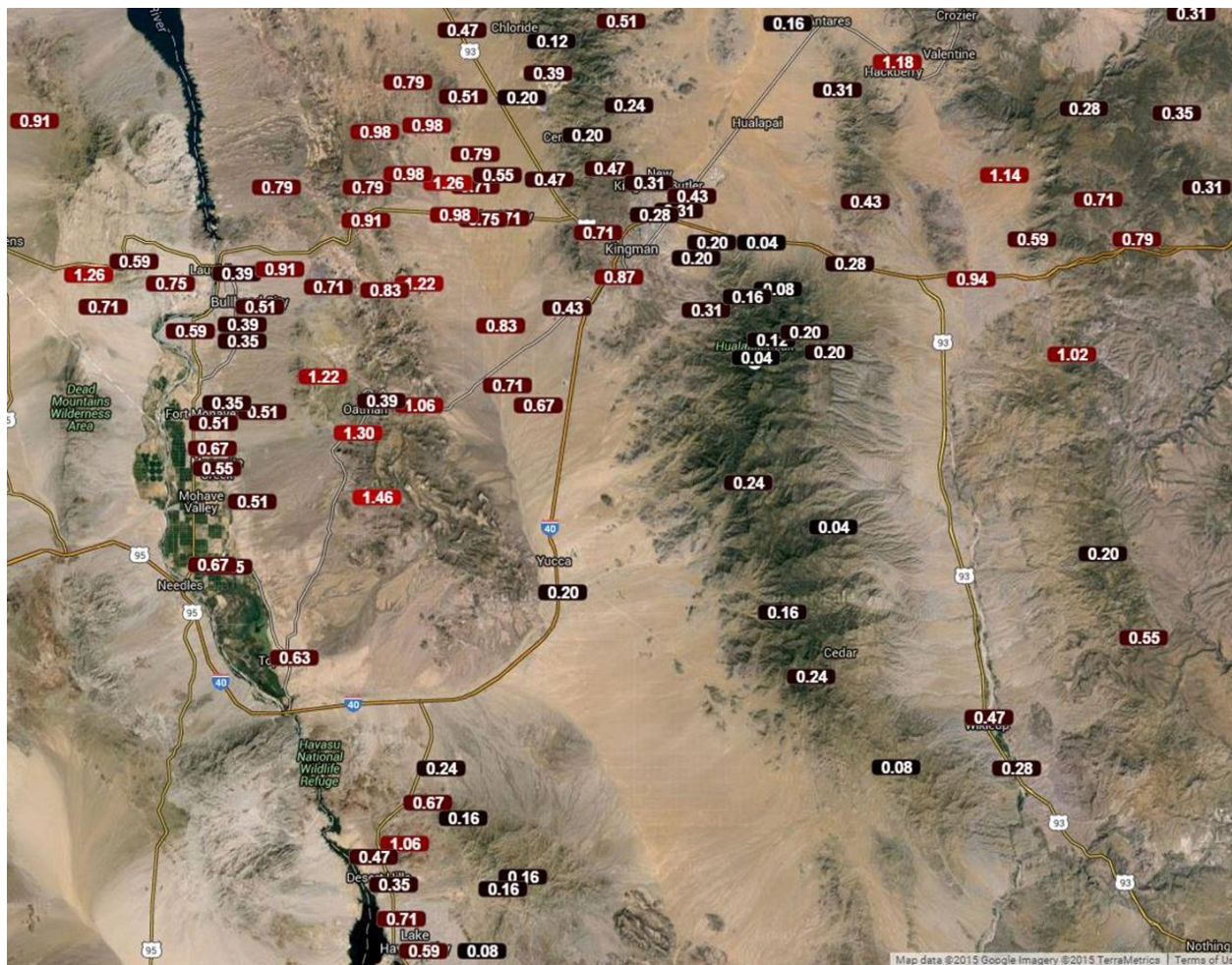


Here is the afternoon sounding from the NWS Las Vegas office on October 18th. Again, the amount of instability, moisture, and upper level wind shear on this sounding led to thunderstorms that produced flash flooding and severe weather. Instability values exceeding 1800 J/KG along with upper level shear from the passing upper level low led to strong thunderstorms developing across eastern portions of San Bernardino, Clark and Lincoln Counties during the timeframe of the balloon release. These thunderstorms yielded reports of hail and high winds across these areas well into the evening hours of the 18th. Numerous thunderstorms moving over the same areas repeatedly introduced the flash flooding threat following the initial severe weather threat.

The October 4-6 Event:

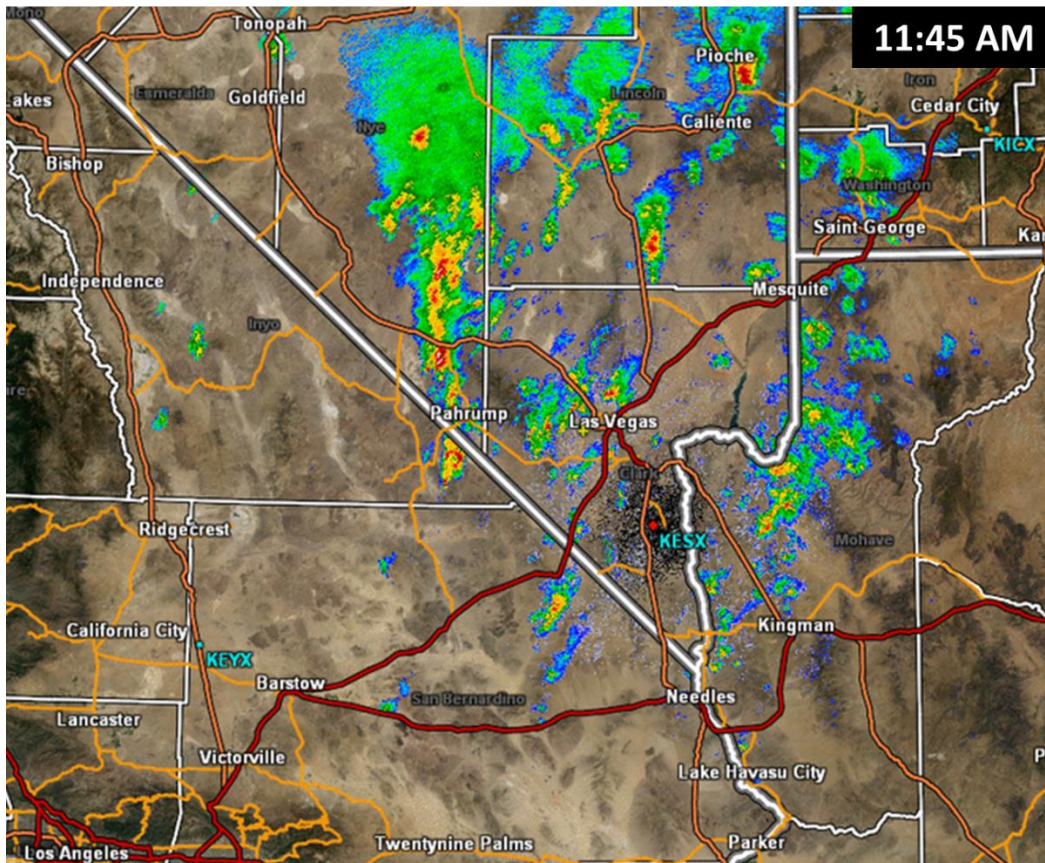


Here is a view of the radar at 7:00pm on October 5th. Several rounds of showers and thunderstorms had previously moved across the area throughout the morning and early afternoon, before additional development took place during the evening hours. Given the instability still available across the area, areas of strong thunderstorms developed, causing flash flooding across portions of the Las Vegas Valley and surrounding areas.

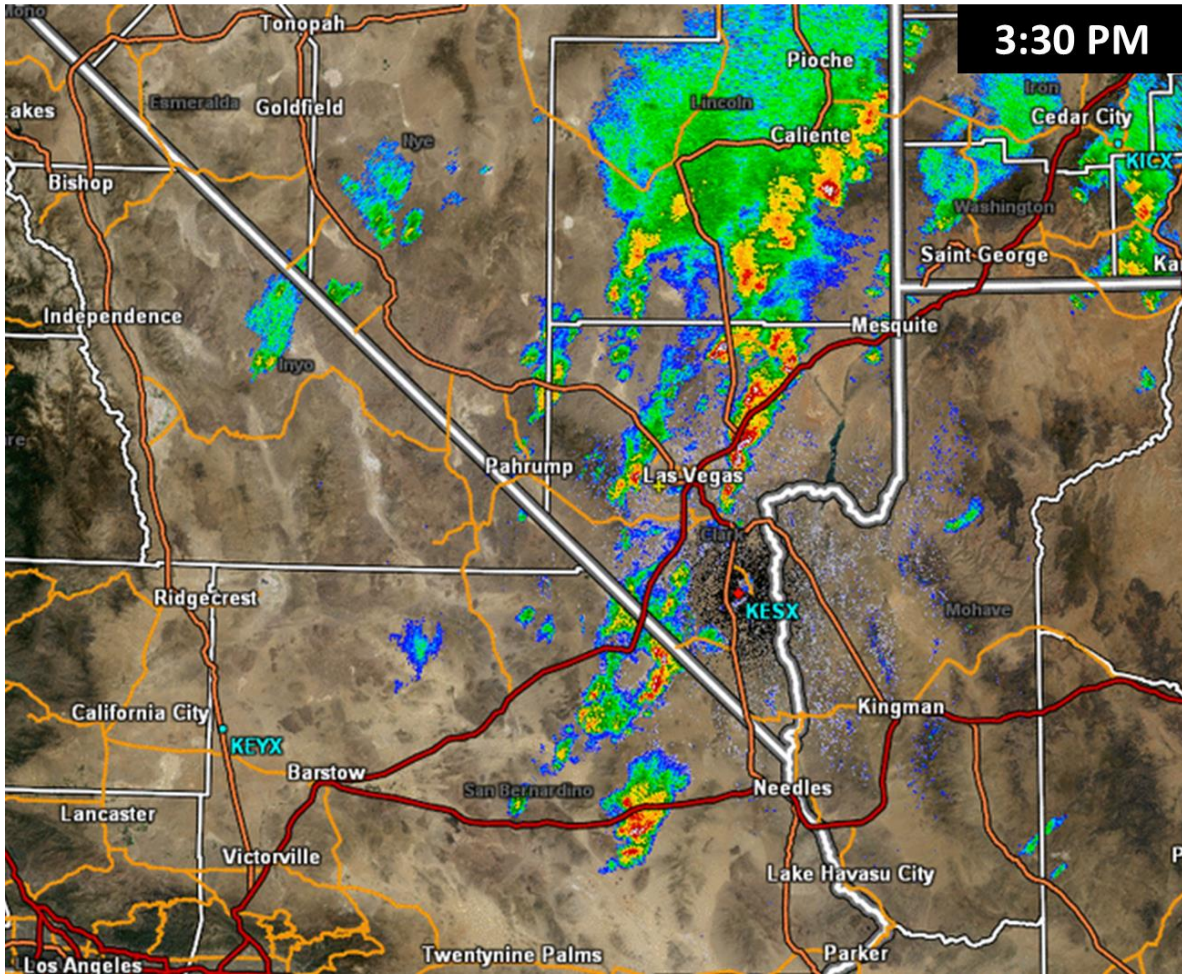


Here is a map of rainfall totals across southern Clark and Mohave Counties from October 4-5th. The majority of the rainfall across this region occurred on October 5th, as the low pressure system moved over the area. Several lines of thunderstorms developed across these areas, and "trained" northward, causing flash flooding across portions of the region.

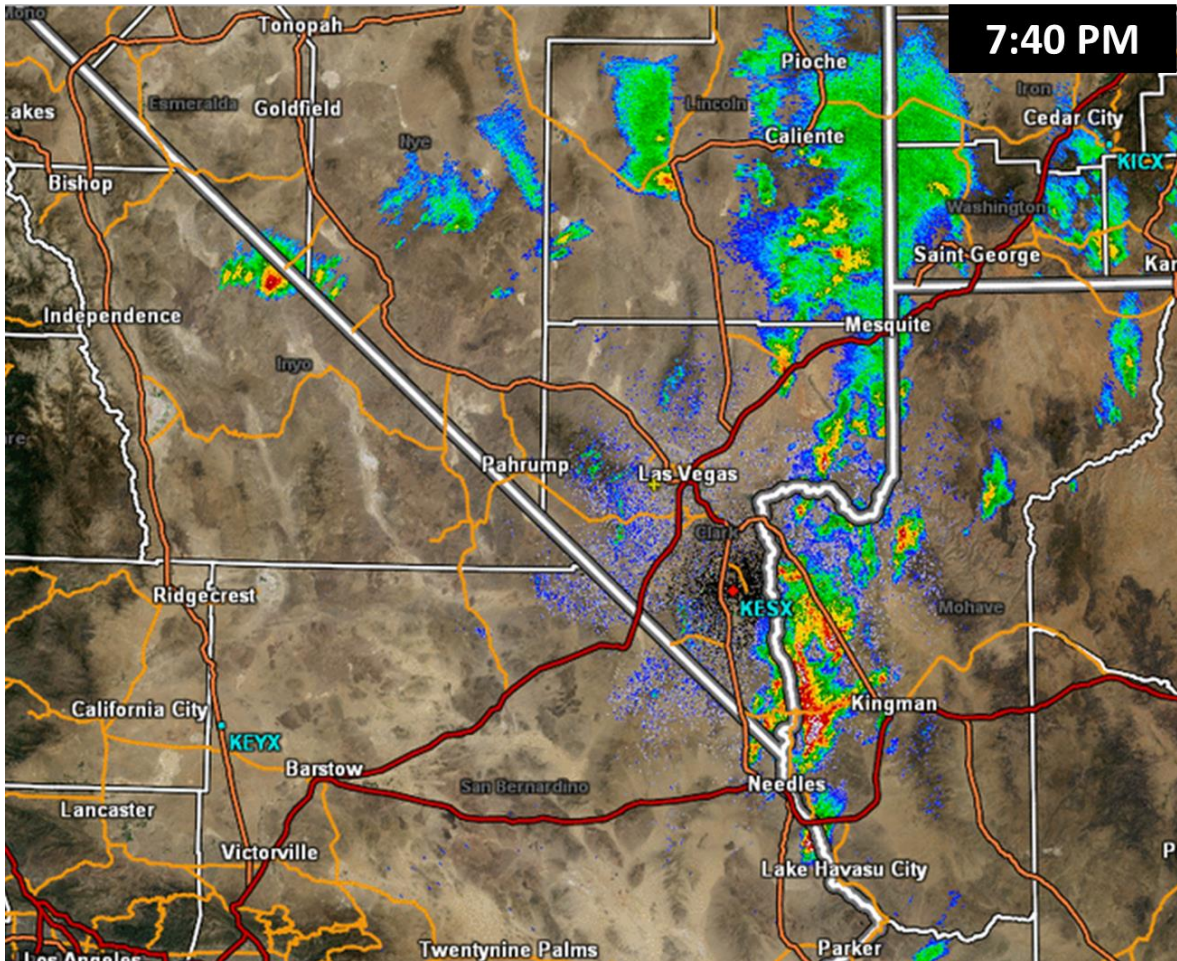
The October 18th Event:



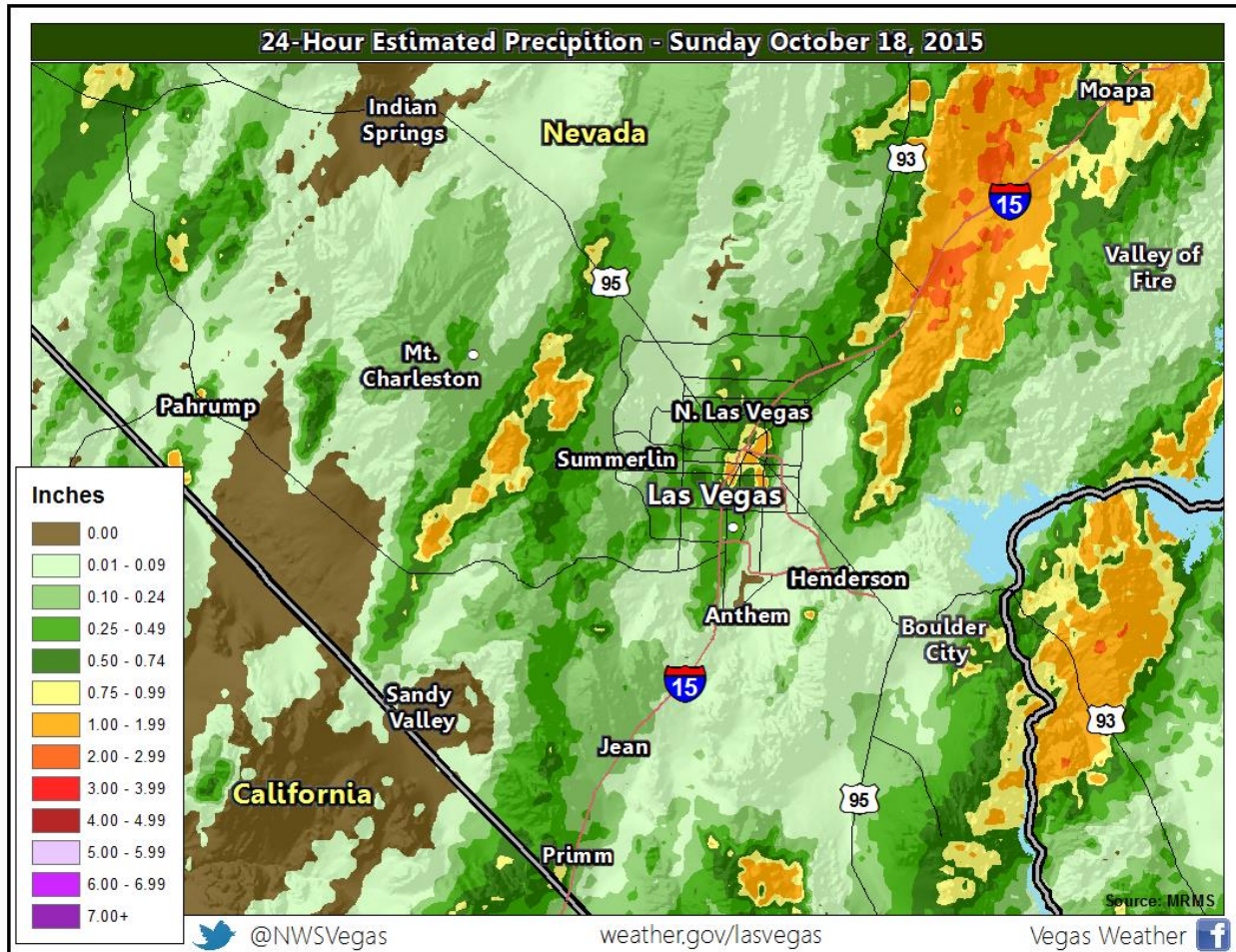
The October 18th event started early, with thunderstorms developing over northern San Bernardino and southern Inyo Counties in southeastern California, moving over southern portions of Death Valley National Park and through Pahrump in southern Nye County, Nevada. A band of well forecast showers and thunderstorms (pictured) developed from northern San Bernardino/southern Inyo County across eastern Nye County by the mid-morning hours. These "training" thunderstorms produced as much as 3 inches of rain across portions of Nye County, leading to numerous reports of flash flooding and road closures, including several stretches of US-95 and NV-160, north of Pahrump.



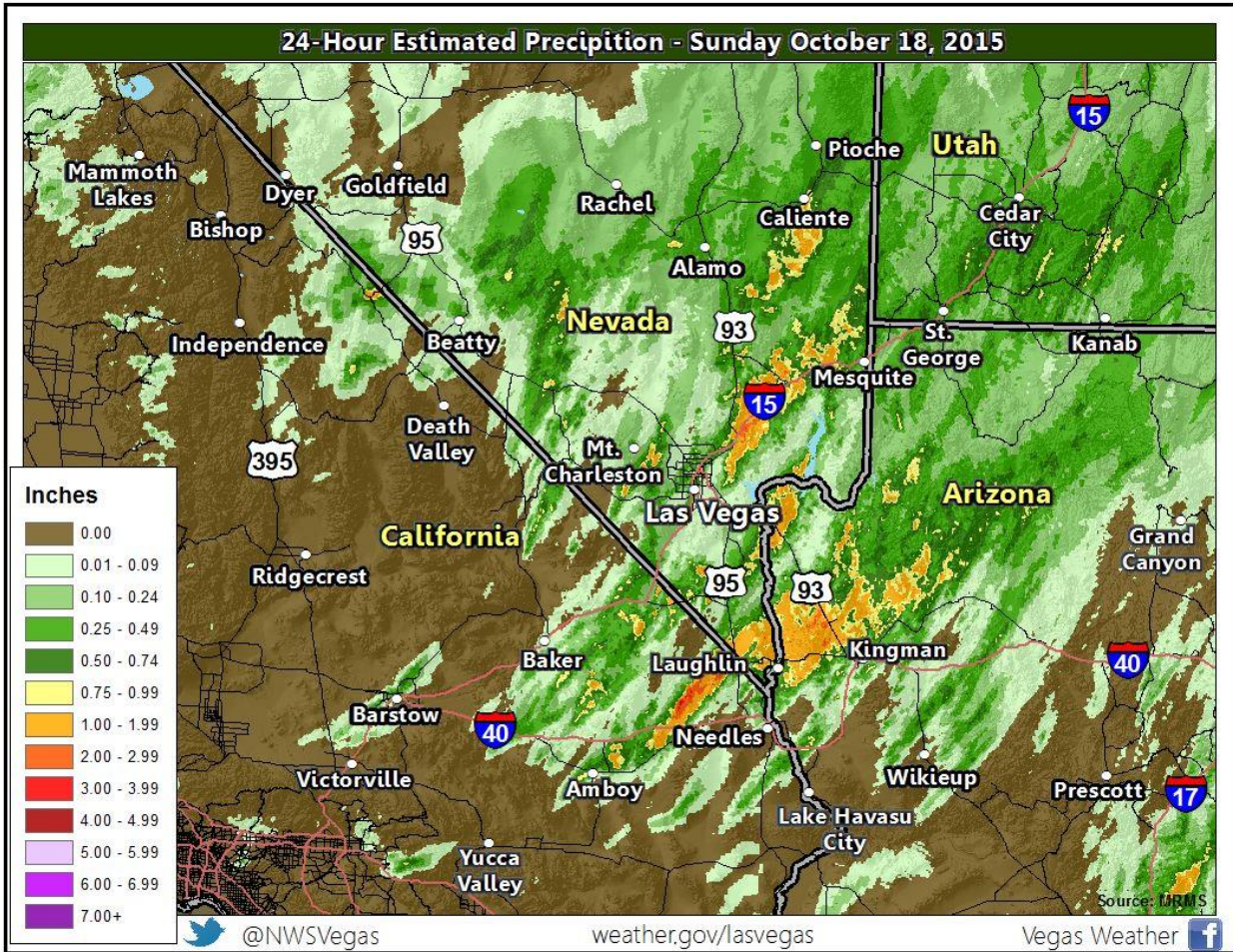
The initial line of thunderstorms gradually moved eastward into Clark and Lincoln Counties by the afternoon hours. Much of the Las Vegas Valley was spared, with heavy thunderstorms from the initial line affecting the Spring Mountains, Red Rock Canyon, NCA, and far northeastern portions of the Valley, yielding flash flooding and at least several swift water rescues in Red Rock Canyon. Strong thunderstorms redeveloped east of Las Vegas by mid-afternoon (pictured), and quickly became severe, producing hail and high winds across open sections of eastern Clark County. Several strong to severe thunderstorms also affected eastern Lincoln County, with reports of large hail and damage in and around Caliente. Thunderstorms along I-40 in eastern San Bernardino County eventually moved into Mohave County, producing flash flooding along the way.



Thunderstorm activity waned across most areas during the evening hours. However, the thunderstorms that produced flash flooding in areas of eastern San Bernardino County during the afternoon hours continued into Mohave County, Arizona, becoming severe. Two distinct severe thunderstorms (pictured north of Kingman, and west of Kingman) became supercells (thunderstorms with a rotating updraft), producing hail as large as ping-pong balls (1.5" in diameter), and winds as high as 70 mph near Golden Valley, Arizona. Storm Chasers spotted at least one funnel cloud west of US-93 with the first supercell, north of Kingman. Additional thunderstorms developed to the south of these two supercells shortly after this radar image, leading to a complex of thunderstorms that marched across the county leaving several areas of flash flooding in its wake. Finally, note the isolated thunderstorms over northeastern Inyo County. These thunderstorms sat stationary over Scotty's Castle and Grapevine Canyon for over 6 hours, producing historic flash flooding in this area. Evacuations took place across the area as a result. However, several park visitors were trapped near Ubehebe Crater by the flood waters.



Here are rainfall totals for the Las Vegas area from the October 18th event. Note the totals in the 1-2" range over northeastern portions of Las Vegas. One thunderstorm developed over this portion of the valley, and produced a quick inch of rain in these areas, leading to nuisance street flooding in these areas. Isolated totals of 2-4 inches were noted along the I-15 corridor, leading to several road closures due to flash flooding, including US-93, north of Apex. I-15 was also temporarily closed at Apex to clean up debris from the roadway due to flash flooding.



Here are rainfall totals for the region from the October 18th event. Note the linear pattern of the heavier rain swaths. These are the result of heavy thunderstorms "training" or moving over the same areas repeatedly. Flash flooding was common in these areas, with numerous road closures, and swift water rescues taking place in some of the harder hit areas, such as northwest of Needles and the Scotty's Castle area of Death Valley. Nearly three inches of rain fell at Scotty's Castle in a five hour time period, making the flash flood there a 1,000 year rainfall event for this area based on the total precipitation that fell in a 6 hour period calculated by estimates in NOAA's Precipitation Atlas 14. Other portions of Grapevine Canyon saw three to four plus inches of rainfall from this event.

Storm Impacts:

October 4-6th

Aviation: Numerous delays and two ground stops on October 5th for McCarran. Delays at times exceeded an hour, peaking at 1 hour and 31 minutes.

Flash Flooding: Significant flash flooding occurred in Death Valley washing out local roadways and stranding at least 150 park visitors. Flooding was also observed in the Las Vegas Valley, Mohave Valley, Golden Valley, and much of the lower Colorado River Valley.

Power Outages: Roughly 1,300 NV Energy customers lost power near Sahara and Lindell for 4-5 hours on the evening of October 5th. A lightning strike caused a power pole fire near Oakey and Eastern Ave. Lightning also struck three power poles in the Amargosa Valley on October 4th.

Road Closures:

-Inyo Co: Whitney Portal Road was closed due to a rockslide. All dirt roads, Badwater Road between Furnace Creek and Shoshone, Dantes View Road, Greenwater Road, Scotty's Castle Road, CA Highway 190 were closed in Death Valley N.P.

-Clark Co: A semi truck hit the median wall and jackknifed, spilling fuel on Interstate 15 near U.S. 95 and closing 3 lanes of the interstate for several hours on 5 October. Valley of Fire road was closed, as well as Hidden Valley Road, Boxcar Road and Callville Bay road.

-Nye Co: Leslie Road near NV-372.

-San Bernardino Co: U.S. 95 and Goffs Road were closed after several vehicles were trapped in flood waters.

-Mohave Co. W. Shinarump Road between Aztec and S. Estrella Road.

Traffic Incidents: At least 76 auto accidents were attributed to the inclement weather in the Las Vegas Metro area.

Winter Weather: Two people suffered hypothermia on Mount Whitney Trail attempting to do a day hike and had to be treated. Accumulating snowfall impacted the higher terrain of the Sierra and Spring mountains. 4 inches of snow was observed at 9,284 feet at the Parchers resort near South Lake, with 1-3 inches observed in Aspendell. An RV was reported to have slid off the road near Boat ramp.

October 18th

Aviation: Two ground stops occurred McCarran totaling over one hour with delays throughout the day. At its peak, departure delays exceeded an hour and 14 minutes.

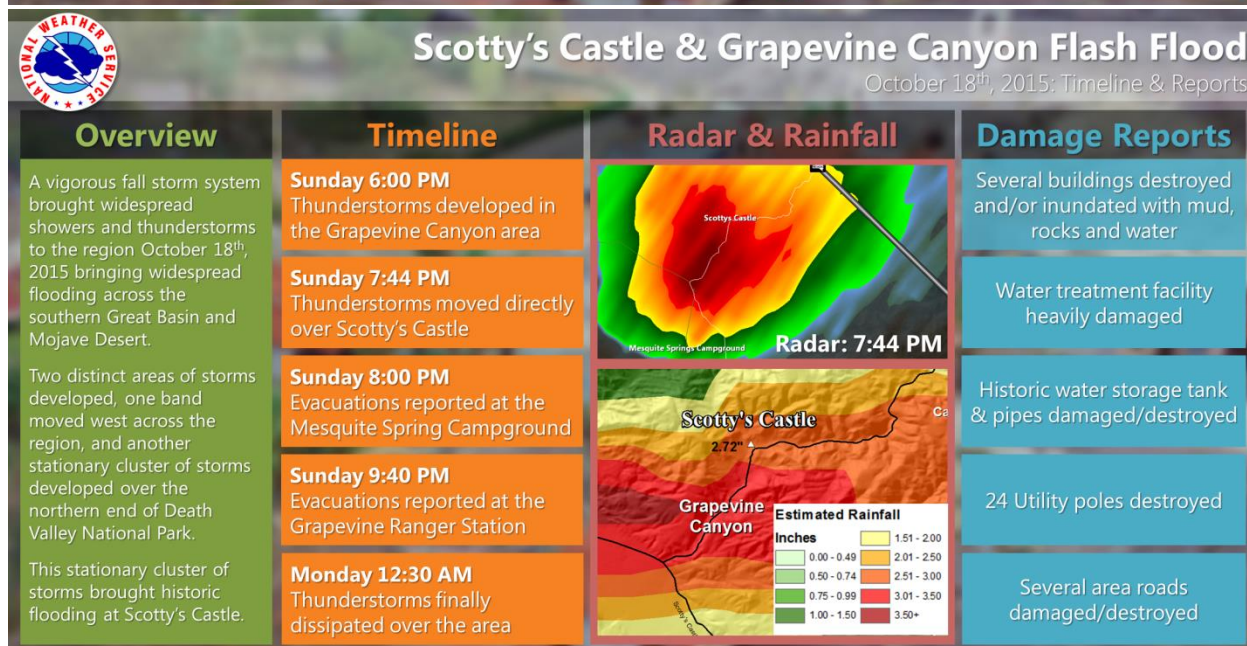
Flash Flooding: A major flash flood deposited nearly 3 inches of rain at Scotty's Castle in a 5 hour period on October 18th. Their annual average is 1.9 inches. This lead to major flash flooding and road closures in the area and significantly damaged Scotty's Castle. Parts of Death Valley National Park were evacuated in advance of the flooding. Scotty's Castle Visitor Center had two feet of mud and debris come inside the visitor center. Numerous main roads through the park were flooded, damaged, or closed during the event and many remained closed a week later. Scotty's Castle Visitor Center has discontinued tours for the foreseeable future until damages can be repaired. Flash flooding also closed other major routes in the region, including US-95 between Beatty and Las Vegas for over 24 hours, NV-160 north of Pahrump, US-93 due to multiple washouts, as well as I-15 at Apex briefly for debris cleanup. Roadways leading to Red Rock Canyon and Valley of Fire were closed due to flooding, resulting in impacts to the park areas.

Severe Weather: A possible tornado occurred near Caliente where a trail of downed shrubs and small trees was visible in photographs sent to us. There are also witnesses who said they observed a tornado. Multiple photos of wall clouds were received via social media between Las Vegas and Valley of Fire, as well as near Kingman and Golden Valley. Storm chasers also spotted a brief funnel cloud along US-93, north of Kingman. Large hail was common with many of the storms, with hail up to 1.5 inches (ping-pong size) reported near Golden Valley, Arizona. Hail of pea sized to as large as dime sized was observed early Sunday afternoon in the northeast Las Vegas Valley.

Power Outages: A power outage lasting roughly one hour was reported following a severe thunderstorm in Caliente.

Major Road Closures: Portions of US-93 & US-95, NV-159 near Red Rock NCA, NV-160 north of Pahrump, All roads in Death Valley National Park, I-15 at Apex for 30 minutes of debris cleanup.

Below are several graphics that were featured on our social media sites highlighting the timeline of the Scotty's Castle flood and answering some frequently asked questions associated with this event.



Photos

Big thanks to all of our social media followers, as well as regional weather spotters who submitted the following pictures to us and provided us with valuable weather updates.

October 4-6 Event



Badwater Road following flash flooding in Death Valley on October 4th.



The aftermath of a flash flood in Death Valley N.P. on October 4th.



Flood waters from a wash inundate this roadway in Death Valley N.P. on October 4th.



Flash flooding over this roadway prevented these park visitors from continuing their drive.



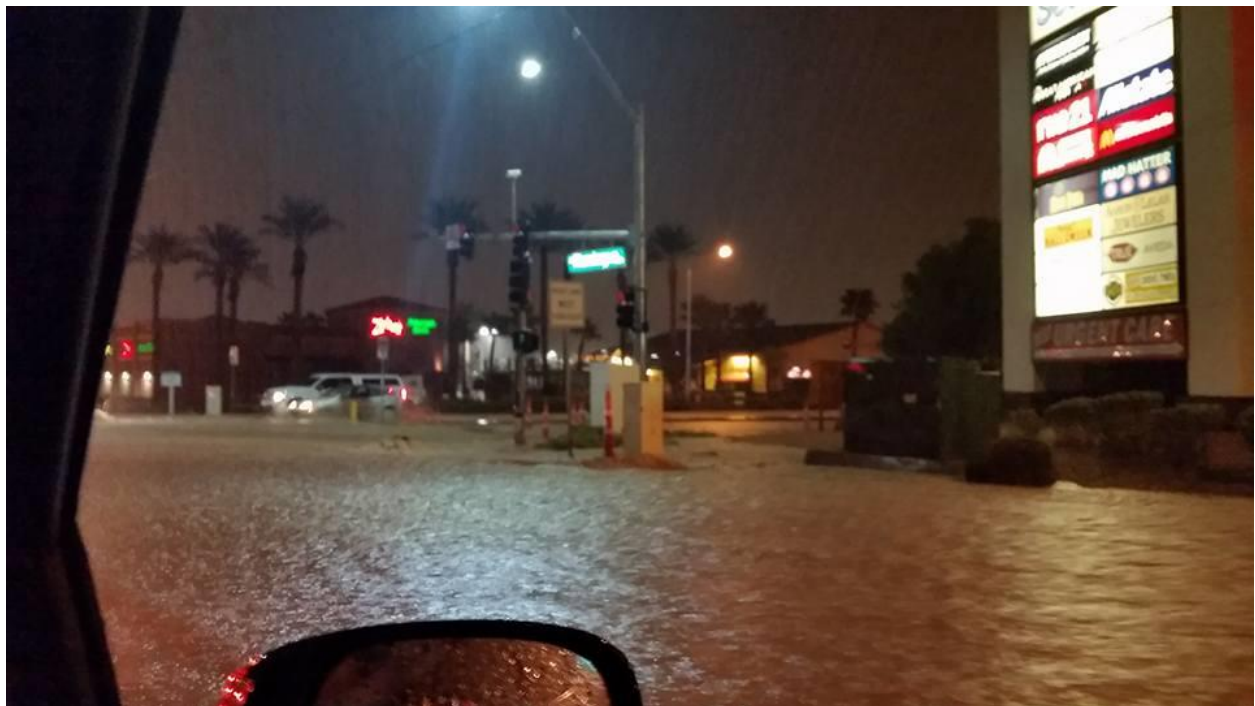
Several travelers observe flash flooding over Badwater road in Death Valley N.P.



This rock slide closed Whitney Portal Road in Inyo County, California.



Portions of Badwater Road were washed out in Death Valley N.P.



Flash flooding occurring in the southwest Las Vegas Valley on the evening of October 5th.



One of several funnel clouds that occurred on October 5th was spotted near Boulder City.



Flash Flooding occurring in Pahrump on October 5th.



Snow was observed at the Bristlecone Pine Forest on October 5th.



Snow was also observed in the higher peaks of Mt. Charleston.

October 18 Event



Flash flooding washed out this roadway near Cork Creek in Clark County.



Standing water was still visible in Badwater Basin days after the Oct 18th event.



One of several wall clouds associated with the supercell thunderstorms that developed northeast of Las Vegas.



Mud and rocks cover Scotty's Castle Road in northern Death Valley N.P.



Flash flooding also managed to wash out several sections of Scotty's Castle Road.



Several feet of mud, rocks, and debris surround and fill the Scotty's Castle visitors center following a flash flood.



Scotty's Castle pool was also filled with water for the first time in history.



An aerial view of the flash flooding aftermath at Scotty's Castle.



Traffic awaits the reopening of US-93 in Lincoln County after flash flooding closed the road.



Left: Cars navigate a flooded US-93 in Lincoln County. **Right:** A wall cloud hovers over the landscape near Lake Las Vegas.